HUMAN FACTOR PROBLEMS IN ANTI-SUBMARINE WARFARE

SUBJECTIVE REACTIONS OF VIGILANCE PERFORMERS

A Supplementary Note to a Study of
Individual Differences in Vigilance Performance

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Supplementary Note to
Technical Reports 2 and 4

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This note supplements the following reports on human factor problems in anti-submarine warfare:

Technical Report 2

A STUDY OF INDIVIDUAL DIFFERENCES IN VIGILANCE PERFORMANCE

Technical Report 4

AN EXPLORATORY STUDY OF THE CORRELATES OF VIGILANCE PERFORMANCE

SUBJECTIVE REACTIONS OF VIGILANCE PERFORMERS

The fifty-four subjects who participated in the study of individual differences in vigilance performance (Buckner, Harabedian, and McGrath, 1960) were interviewed after the conclusion of the experimental sessions. The information obtained in those interviews is reported here as a supplement to the empirical data reported in Technical Reports 2 and 4. An increased understanding of the subjective reactions of vigilance performers may result in improved experimental designs and in new insights in the development of theories of vigilance.

PURPOSE

The experimenters' objectives in conducting the interviews were (1) to obtain introspective reports concerning the subjects' general attitudes toward the experiment; (2) to obtain information regarding any change in the motivational state of the subjects as the experiment progressed from week to week, and any change during a typical one-hour watch; and (3) to get some indication of the subjects' intellectual approaches to the vigilance tasks.

METHOD

Each subject was interviewed privately about ten days following the last experimental session. The interview was tape recorded with the knowledge and consent of the subject, who was informed that his remarks would be kept entirely confidential and was encouraged to speak frankly about his feelings toward the experiment. The subjects were told that the experimenters desired an account of their reactions to the experiment so that the findings could be interpreted more meaningfully.

Direct questioning was generally avoided in the interviews; a non-directive approach was used. The interviewer attempted to follow up whatever seemed to be most important to the subject. There were rather wide differences in the ability

or willingness of the subjects to report their feelings and reactions to the experiment, but they were generally cooperative.

GENERAL ATTITUDE TOWARD THE EXPERIMENT

The subjects agreed unanimously that the vigilance tasks were boring and tiresome. No one expressed a liking for the tasks; the subjects expressed either a dislike for the tasks or a neutral attitude toward them. Several subjects said they could see no sense in what they were required to do, and that the whole thing seemed rather silly. But even so, they felt the need to do as they were told and to make the best of the situation. Some saw the experiment as being important to the design of sonar equipment, but few felt they had any personal stake in the outcome of the experiment.

As a group the subjects had a neutral attitude toward the experiment, regarding it as "something that had to be done," but not as a job that had personal meaning for them. Many subjects expressed the feeling that even though they didn't particularly like the experimental tasks, it was better to participate in the experiment than to perform their normal "casual" duties (watering lawns, cleaning toilets, etc.). It can be concluded that the subjects who took part in this experiment were not highly motivated.

CHANGES IN ATTITUDE DURING THE EXPERIMENT

The majority of the subjects said they were interested and motivated at the beginning of the experiment and then became quite bored toward the end. With regard to their feelings during the first week of the experiment, the subjects used such phrases as:

"pretty interesting,"

"kind of fun, like a game,"

"a challenge,"

"like a new adventure,"

"curious and interesting."

Describing their feelings during the last two weeks of the experiment, the subjects used such phrases as:

"afterward it was more routine and habitlike,"

"just plain boring,"

"after a while you just did as you were told,"

"became very tiresome,"

"at the end, it didn't matter much,"

"I really got disgusted with it at the end."

On the other hand, there were some subjects who said that the experimental sessions were exceedingly boring and tiresome at the beginning of the experiment, but after a couple of weeks had gone by and they had become used to the task, they began to develop some interest in it.

With regard to the perceived difficulty of the task, some felt the task was difficult at first and then became easy, while others felt the task was easy at the beginning and then became difficult as time went on. The majority of the subjects said that while they became more and more bored with watchstanding, it became much easier to detect signals toward the end. It is interesting to note that the subjects felt their performances were steadily improving on both tasks during the course of the experiment. The empirical facts, however, indicated that performance on the visual task steadily deteriorated from week to week.

CHANGES IN ATTITUDE DURING A TYPICAL EXPERIMENTAL SESSION

The experimenters were particularly interested in determining whether the subjects had a different attitude or set toward the task during the regular one-hour watch period than they had during the two-minute pretest and posttests.

There was common agreement among the subjects that they were much more alert and "on the ball" during the pretest and posttest than during the one-hour watch. In fact, the subjects said that when the red light flashed to indicate the beginning of the one-hour watch, they regarded it as a signal to relax and take it easy, to get comfortable, settle down, and so forth. A number of subjects indicated that they deliberately assumed a less attentive attitude, because they felt they could not last out a whole hour in a completely attentive attitude. In other words, the subjects consciously paced themselves.

Some subjects said they hated to see the red light indicating the end of the pretest and the beginning of the watch, because it signaled the start of an hour of boredom. Others indicated that the light meant they could sit back and relax a bit because they were not going to get so many signals. Some even said that it meant to them that they had an opportunity now to read their mail, perhaps write a letter, or just take it easy. When asked why they felt they could do such prohibited things as reading and writing, they invariably answered that they were not expecting many signals and there was not so much need to remain alert.

The subjects in the vigilance experiment appeared to assess the probability of missing a signal by not attending to the detection task and when this probability was lowered during the watch period, they were more willing to take a chance on extraneous behavior interfering with their detection performance.

When asked to report their reactions to the final red light which signaled the end of the watch and the beginning of the posttest, the subjects unanimously described a heightening of alertness in expectation of the occurrence of signals. Some typical descriptions of reactions to the posttest light were:

> "you'd really perk up,"
>
> "when the last red light came on, you automatically got more alert,"
>
> "I'd be raring to go."

The posttest light also seemed to have a powerful motivating quality, evidently because of its association with the much-welcomed end of the watch. This can be seen in the following comments:

> "I felt relieved when I saw the last red light and felt more alert,"
>
> "You were always happy when you got that last light because you knew you'd be out of there in a few minutes,"
>
> "You just kept on going and hoping for that last red light,"
>
> "When you saw that light you felt better. I was really glad to get out at the end,"
>
> "That light looked real good."

PROBLEM SOLVING BEHAVIOR

There seemed to be some real differences between subjects in their intellectual approach to the vigilance tasks. Some subjects went to extensive pains in attempting to discover methods of improving their detection performance. Other subjects engaged in no problem solving behavior whatever, but merely did as they were told and watched or listened for intensitive changes in the stimuli. There seemed to be two problems facing the subject: to detect signals and to stay awake.

Subjects' approaches to the detection problem. The subjects used three general approaches to the problem of identifying signals: (1) attempting to find a pattern in the signal presentation schedule, (2) attempting to find stimulus cues to a signal in addition to the change in intensity--the intended signal stimulus, and (3) manipulating the equipment.

A large number of subjects deliberately attempted to search out patterns of signals but gave up the effort after a week or two. Some even kept records for a week or so; one subject actually counted all the background stimuli and signal stimuli presented on two watches. All of the subjects agreed eventually that there was no way of knowing how many signals they would get or when the signals would

occur. A few subjects thought they had found a pattern of signal presentation during the pretest that "worked for a few days." Other subjects said they had heard of this pattern, but could not find it. Even those subjects who were certain they had found a pattern of pretest signals said that they did not rely upon it, but merely used it as a sort of game—trying to guess when a signal would come. Actually, sixteen different pretest schedules were used, each presented once on the auditory task and once on the visual task. Of these sixteen schedules, no two were identical, mor even similar.

It was surprising to note that the subjects could not tell from the first half of the watch how many signals they would get in the last half of the watch. They evidently did not discriminate between the high and low signal rates that were used in the study. This may account for the lack of a significant effect of signal rate on performance. It may be that an observer must consciously recognize a change in signal rate for his detection performance to be affected by such a change.

Some subjects tried to find additional stimulus cues to aid in detection and reported a variety of these cues. For example, one subject said the tone rose in pitch when an auditory signal was presented; but another subject said the tone fell in pitch. Two subjects reported a change in the duration of the stimulus when a signal was presented; however, one said it was shorter and one said it was longer. Another subject said the inter-stimulus interval was shorter just before a signal. According to still another subject, the intensity of the background stimuli systematically changed just before a signal—the background tones or lights would suddenly drop in intensity and remain low until a signal came.

These reported cues appear to be invalid not only because of the disagreement among the subjects, but also because there was no basis for them in the instrumentation of the displays. Even those subjects who mentioned these extraneous cues said they did not use them as their basis for reporting signals. They felt the change in intensity of the stimulus (the intended signal) was sufficient to

leave no doubt about when a signal occurred.

In trying to improve their detection performance, a number of subjects manipulated or re-arranged their equipment. For example, they would put the visual display box on the floor and stare down into it or hold it above their heads and stare up at it or try looking at the light with one eye and then the other, alternating eyes regularly. They would sometimes shift the headphones around using one ear and then the other or would set the headphones on the backs of their necks or hold them in their hands. Practically all of these subjects agreed that none of these efforts seemed to help and they reverted to the original instructions.

On the first day of the experiment, the subjects in one group attempted to communicate between booths when they detected signals. However, the experimenters discovered this and immediately stopped the practice. In the interviews, it was determined that the initial warning was sufficient and no further between-booth communication was attempted.

Subjects' approach to the problem of staying awake. The main problem-solving task as far as most subjects were concerned eventually boiled down to trying to stay awake rather than trying to detect signals. Most of the subjects agreed that after a while they were very easily able to detect the signals and had no difficulty in distinguishing between a true signal and a background stimulus. However, it became more and more difficult for many subjects to stay awake as the weeks of watchstanding progressed. The efforts of the subjects to remain awake were varied and in some cases bizarre. Among the more common activities reported were day-dreaming, reading, writing letters, standing up and walking around the small booth, and smoking. Some subjects engaged in "war games." That is, they would pretend that they were monitoring a crucial display during wartime and that the signal represented a real enemy target. A few mentioned that they would sometimes push their response button even when they were well aware that no signal had been

presented, but "it was just something to do." One subject reported that he systematically counted all of the holes in the perforated acoustical material lining the interior of the booth. A large number of drawings, "literary excerpts," and various other slogans were found written on the equipment and walls of the booths. The experimenters knew of at least one instance of masturbation in the booths.

The problem of staying awake in the booths was uppermost in the minds of many subjects. At one extreme, two subjects refrained from going on liberty, because they wanted to be certain of always getting a good night's sleep so they would not fall asleep on watch. On the other hand, there were some subjects who said they deliberately went to sleep on watch, but attempted to awaken before the end of the watch.

THEORETICAL IMPLICATIONS OF THE SUBJECTS' INTROSPECTIVE REPORTS

It would seem that most of the theories of vigilance behavior can find support in some of the introspective reports of the subjects in this experiment. For example, the reinforcement-inhibition theory of vigilance performance would be consistent with the subjects' statements that they felt a decreasing willingness to even look at the light after long periods of not receiving a signal. That is, as they continued to look at the light or listen to the tone and no signal would occur, they would deliberately look away from the light or remove the headphones for brief periods. Further, there were some definite reactions that strongly implied that detecting a signal was reinforcing. Subjects would make such remarks as:

> "I felt highly gratified when I spotted a signal,"
>
> "I felt a sense of exhilaration when I grabbed a signal."

There were other subjects who made such statements as:

> "When I didn't get any signals, I felt that I had let myself down or I let somebody else down,"

"It seemed like a great waste of time after you're in there for an hour and you caught only one or two signals."

In other words, it seems that detecting a signal was indeed rewarding for at least some subjects and watching or listening fruitlessly for a signal was dissatisfying. These reactions seem consistent with Holland's (1958) approach to the problem of vigilance behavior.

Another way of considering the results of vigilance studies has been termed the "expectancy" hypothesis (Deese, 1955). This view holds that the probability of a response to a signal is a function of the probability of occurrence of that signal, the probability of occurrence being derived from the past incidence of signals. It appears from the introspective reports of the subjects in this experiment that they did make probability judgments about the chances of a signal occurring at different intervals during the watch. These differences in expectancies are most striking in comparing the pretest and posttest with the regular watch. The subjects stated that they were more alert during the pretest and posttest because they expected more signals and that they were more relaxed and less alert during the one-hour watch because they did not expect as many signals. The group detection performance curve (see Technical Report 2) coincides with this stated shift in expectancy.

A third approach to the explanation of vigilance decrement may be termed the activation hypothesis. The general explanatory principle is that as the background stimulation decreases, the state of arousal decreases, and performance declines. It would appear from the reports of the subjects in this experiment that it was important to them to find stimulation of some kind to maintain wakefulness and alertness on watch. The types of activities engaged in by the subjects while they were on watch is evidence of their need for some kind of stimulation other than the monotonous stimulation of the task stimuli. It might also be noted that many of these activities (smoking, reading, etc.) were strictly prohibited and were

repeatedly warned against by the experimenters and by the subjects' superior officers. Nevertheless, the subjects still felt the need was great enough to take the risk of being caught.

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